Understanding Wheelchair Use Patterns: Tilt-in-Space

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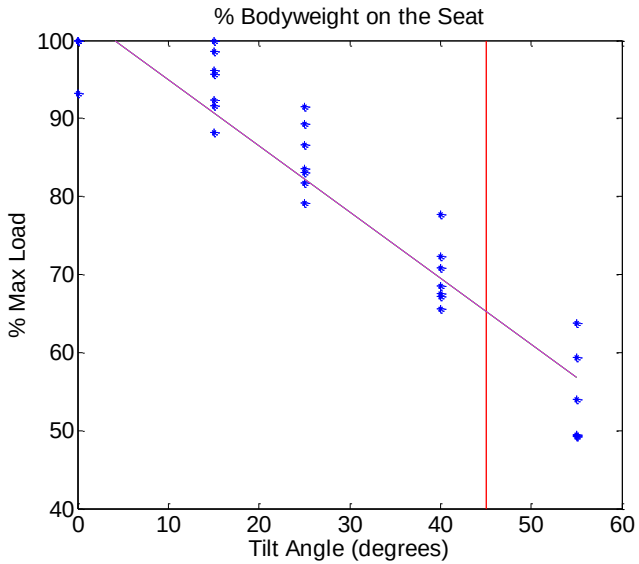
Background

- Pressure ulcers (PUs) are a problem
- PUs are caused by loading
- Managed clinically via:
  - cushions and support surfaces (magnitude)
  - pressure reliefs (duration)
- When independent pressure reliefs are not an option, powered tilt or recline may be employed.

How far to tilt?

- Studies say interface pressure decreases as tilt angle increases.
- Is 45º magic???
- Chris Maurer, MPT, ATP presented at ISS 2007:
- Many clinicians teach 45º or "all the way back"
  - more is better, even without magic angle
- Literature varies between > 30º and up to 45º



Lacoste, M., R. Weiss-Lambrou, et al. (2003). Assist Technol **15**(1): 58-68.

Purpose of the Current Study

- To explore how fulltime power wheelchair users utilized their tilt systems.
  - Did participants utilize their tilt feature?
  - Did participants perform regular weight shifts?

Methods: Subjects and Protocol

- Convenience sample: N=16 (11 men, 5 women),
- Fulltime power wheelchair users
- Varying diagnoses
- 2 weeks of monitoring
- WhAMI (Wheelchair Activity Monitoring Instrument)
  - Occupancy switches
  - Accelerometer for tilt angle
  - Record every 2 seconds

Methods: Variables

- Occupancy Time
- % Occupancy time at each position
  Small < 15º; Medium 15-29º;
  Large 30-44º; Extreme >45º
- Tilt
  - Reflects use of tilt feature
  - Position change of 5º in either direction lasting ≥ 20 seconds
- Pressure Relieving Tilt (PRT)
  - Backwards tilt to a position > 30º lasting ≥ 1 minute
- Tilt Frequency (either tilt or PRT)
  - # tilts on a day / occupancy time on the same day, reported in tilts per hour

Results: Occupancy Time

- Median = 11.0 hours per day
- range: 5.0-16.6 hours
- 6 subjects spent >12 hours per day in wheelchair

Results: Breakdown of Day

- 5 Subjects (yellow) spent most of their time upright.
- Only 6 subjects (blue) tilted to 45º
- Some subjects never reached 30º
- Some subjects spent most of their time between 15º and 30º

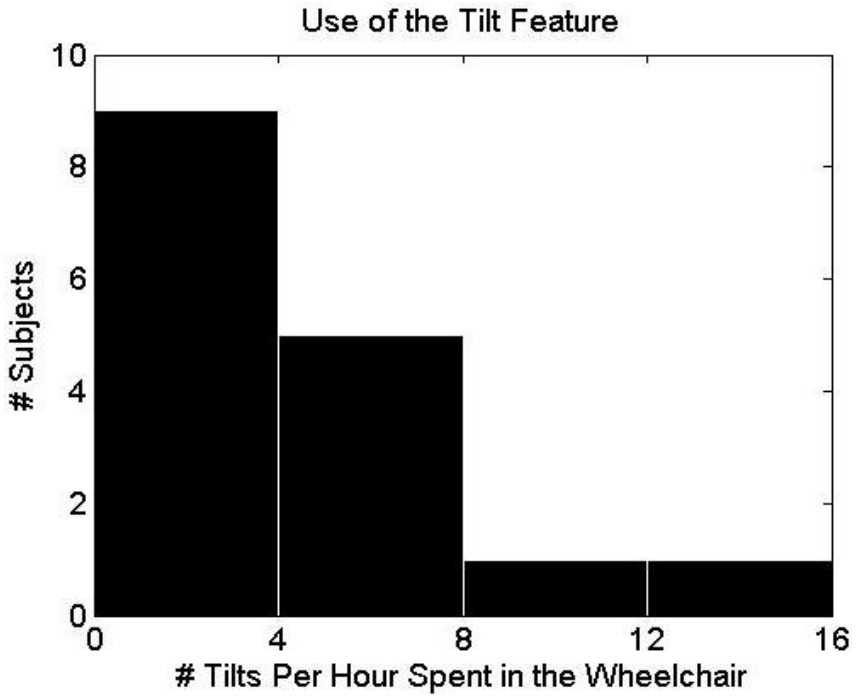
Subject	% of Time in Wheelchair			
	< 15°	15°-29°	30°-44°	≥ 45°
1	91%	5%	2%	2%
2	93%	6%	0%	0%
3	98%	1%	1%	0%
4	98%	2%	0%	0%
5	100%	0%	0%	0%
6	25%	67%	8%	0%
7	36%	63%	0%	0%
8	37%	61%	3%	0%
9	39%	58%	2%	1%
10	19%	52%	29%	0%
11	28%	42%	30%	1%
12	54%	26%	6%	14%
13	70%	9%	21%	0%
14	80%	6%	13%	1%
15	84%	5%	9%	3%
16	84%	16%	0%	0%

Results: Use of Tilt Feature

- Recall:

  Tilt = a change of 5º for 20 seconds
- Nearly half of subjects tilted regularly

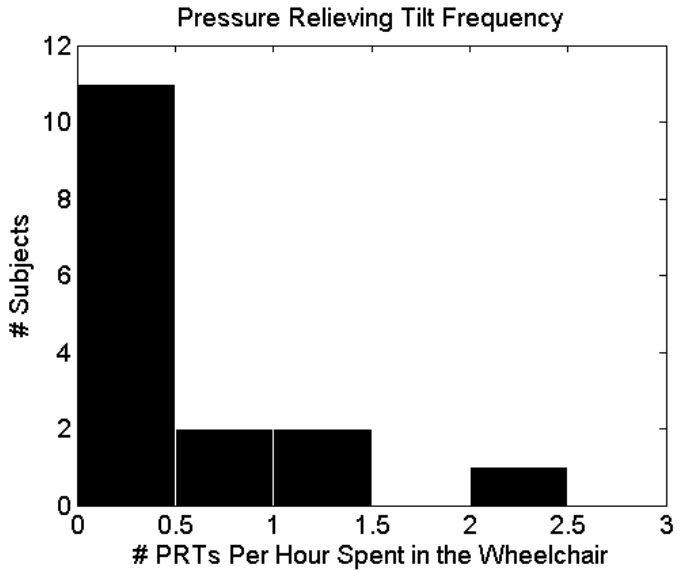
  (1 x / 15 minutes)



Results: PRT Frequency

- Recall:

  PRT = tilt > 30º for 1 minute
- Median subject = 1 pressure relieving tilt every 7 hours
- Only 3 subjects performed pressure relieving tilts at least once per hour.



Discussion

- Did participants utilize the tilt feature?
  - Most subjects (15/16) utilized their tilt feature
  - Frequent, small position changes (4/hour)
  - Most subjects sat at more than 2 different positions throughout the day
  - Diverse types or styles of use
- Did participants perform regular weight shifts?
  - No!
  - Little to no tilting to 45º
  - Infrequent tilting past 30º

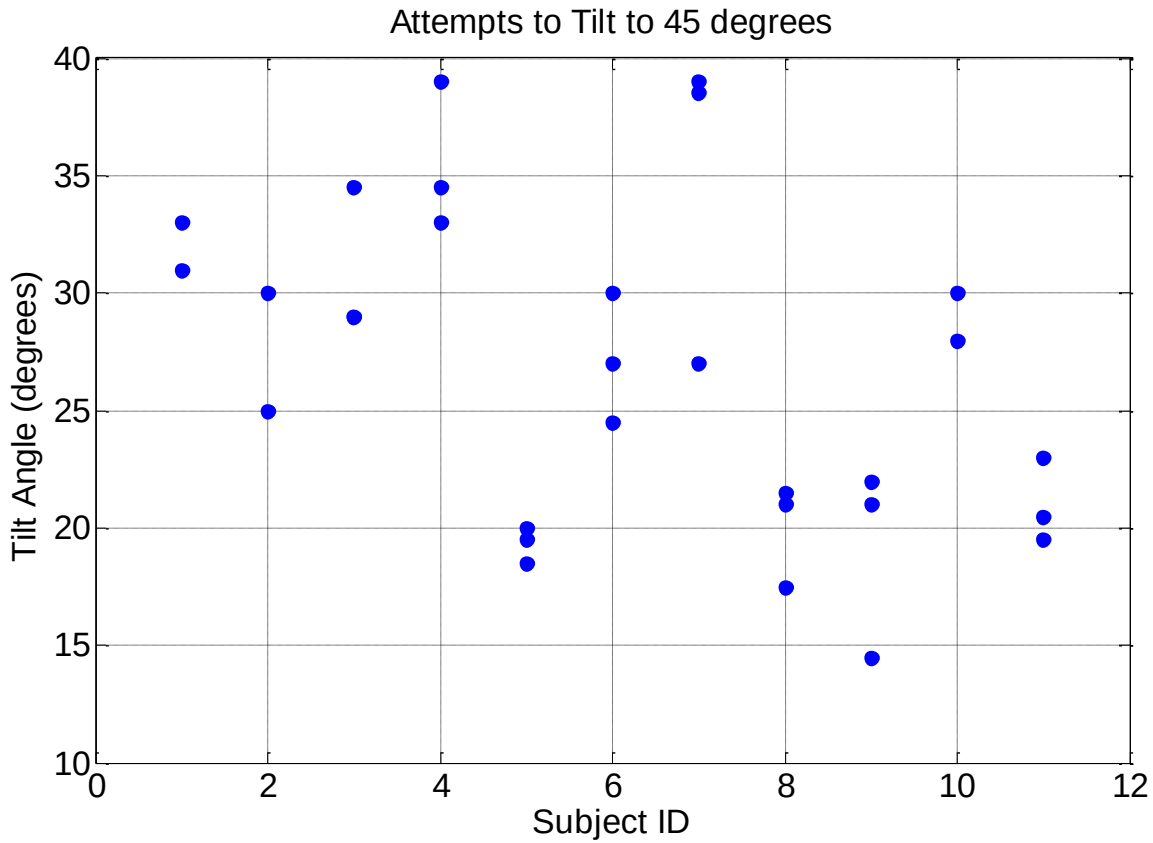
Discussion: Questions Raised

- What benefits are people getting from small to medium sized tilts (<30º)?
- How can we predict who will take advantage of their tilt system?
- Why do so few people perform pressure relieving tilts with the recommended frequency?
  - What can we do to encourage people to tilt to 45º more frequently??
- Why do few subjects tilt to 45º ?
  - What can we do to encourage more people to tilt as far back as 45º or greater?
- Are we training people properly to utilize tilt (frequency and magnitude) as clinicians intend?

Pilot Study: Tilt Perception

- N = 11 able bodied students
- Adjusted footrests on a tilt-in-space power wheelchair for optimal fit
- Asked to tilt "as far as needed for pressure relief", measure actual angle (x3)
- Asked to tilt to 45º, measure actual angle (x3)
- Shown 45º of tilt and asked to replicate the position, measure actual angle (x3)
- Will repeat 1 week later to see if they recall how far to tilt.

Pilot Study: Tilt Perception



Pilot Study: Tilt Perception

- Overall: Mean 27º ± 6º (off by 40%!)
- With no training, 45º is much farther back than people expect
- Consistent with subjects in study

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RERC

Questions?